AN EXAMINATION OF THE EFFECT OF TEACHER SALARIES ON STUDENT ACHIEVEMENT IN FLORIDA PUBLIC SCHOOLS

A Thesis submitted to the Graduate School of Arts and Sciences of Georgetown University in partial fulfillment of the requirements for the degree of Master of Public Policy in the Georgetown Public Policy Institute

By

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ABSTRACT

Among school-based factors, existing evidence strongly supports the idea of teacher quality being the most influential variable impacting student achievement. Taking the implications of this knowledge and expanding them to a broader level of analysis suggests that the quality of the teacher workforce is the single most important factor in educational achievement across an entire student population. Building a quality teacher workforce entails capacity to recruit and retain qualified candidates at a sufficient level. Microeconomic theory dictates that the teaching profession is subject to the very same forces of supply and demand which govern all other labor markets, indicating that salary levels are a viable policy tool in efforts to recruit and retain qualified candidates, build a quality teacher workforce, and boost student achievement. After controlling for both teacher and student population characteristics across sixty-three Florida public school districts, multivariate OLS regression analysis confirms the hypothesis that teacher salary levels have a positive and statistically significant effect on student achievement. The empirical findings
offer substantial insights to the aid of education policymakers in weighing cost effective methods for improving the performance of public education systems.
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Chapter 1. Introduction

Examinations of the relationship between school resources and student outcomes continue to encompass a greater share of the literature produced in education policy each year. Yet, conclusive evidence remains elusive while the debate between those who advocate for greater financial investment in schools and those who discourage “throwing money at schools” rages on. At the heart of this debate are the nation’s some 3 million plus public school teachers, whose salaries and benefits constitute the greatest expenditure amount in public education funding (Chait, 2007). Consistent with the overall picture painted on school resources, existing literature has found little to no evidence of any systematic relationship between observable teacher characteristics and student performance. This has, however, only fueled the debate on how to compensate teachers, since research does show teacher quality to be the single greatest school-based factor impacting student performance, and that such quality varies substantially across the workforce.

The debate over how to compensate teachers can also be broken into two general camps. On the one side are those who advocate the strengthening of certification requirements, to be complemented with across-the-board salary increases, to ensure that no child receives a poor teacher. On the other side are those who advocate the loosening of certification requirements to increase the pool of teacher recruits, and tying compensation more closely to student achievement, primarily as measured by a standardized test. Teacher salaries, especially base or starting salaries, are therefore at the heart of this debate. Given the evidence on teacher quality and the fact that teacher
salaries account for the greatest share of overall public education funding, they must factor crucially into the considerations of education policymakers at all levels.
Chapter 2. Literature Review

Among school-based factors, the evidence is strongest behind the factor of teacher quality as a determinant of student achievement. This suggests that the abilities and qualifications of the individual teacher standing before his or her students in the classroom help to determine their educational attainment more than any other known variable. In a sample of low-income minority students whose average achievement in primary school was below the national average, Hanushek (1992) demonstrated that teachers near the 95\textsuperscript{th} percentile of the quality distribution can be worth as much as an entire year’s worth of additional learning to their students compared to teachers at the 5\textsuperscript{th} percentile. In a later analysis by Rivkin, Hanushek, & Kain (2005), the authors conclude that school quality is an important predictor of student achievement, with teacher quality being the most significant factor, explaining at least seven percent of the variance in students’ test scores.

Using data from Tennessee’s Value-Added Assessment System (TVAAS), Sanders & Rivers (1996) discovered that the effects of teachers on their students are both “additive and cumulative,” with three years of having a quality teacher being associated with a difference in student achievement of more than 50 percentile points, and the effects being constant across all ethnicities. In a later study that also made use of TVAAS, Sanders and Horn (1998) found race, socioeconomic level, class size, and classroom heterogeneity to be “poor predictors of student academic growth” while “the effectiveness of the teacher is the major determinant of student academic progress” (p.247). These findings are consistent with those of Darling-Hammond (2000), who also discerns teacher quality to be superior to competing educational factors, and concludes
that it can overcome student background defects such as low socioeconomic, minority, and different language status.

Taking the implications of this knowledge and expanding them to a school, district, or even state level of analysis, it may then be surmised that the quality of the teacher workforce is, in all likelihood, the single most important factor in the improvement of achievement across an entire student population (Peterson 2003), supporting the notion that the ultimate success of the U.S. public education system “depends upon the skills of the 3.1 million teachers managing classrooms in elementary and secondary schools across the country” (Gordon, Kane, & Staiger 2006, p. 5). Just as a teacher workforce is the sum of its teachers working in their respective classrooms, so too is a student population the sum of its students learning from those same teachers in those same classrooms. If the quality of the teacher is, relatively speaking, a highly significant factor in the educational achievement of the student, then the quality of the teacher workforce must, for all intents and purposes, be assumed to be a highly significant factor in the educational achievement of the students, or student population (Goldhaber 2006).

Defining a Quality Workforce

At the classroom level of analysis, the primary concern is over the abilities and qualifications of the individual teacher standing before his or her students seated in their respective desks. At a school, district, or even state level of analysis, the primary concern adaptively expands to include having an adequate supply of teachers to occupy the demanding number of classrooms. That is, the concern becomes one of both teacher quality (at the classroom level) and quantity (at the school, district, or even state level). This working definition for a quality teacher workforce may be seen as consistent with
the general definition for any quality workforce: an adequate supply of appropriately skilled individuals. Attaining an adequate supply entails an ability to recruit and retain employees at sufficient levels. It likewise follows that ensuring that those who are recruited and retained possess an appropriate skill set is requisite upon recognizing what constitutes quality and providing commensurate incentives to reinforce such quality.

Recruitment and retention of a quality workforce depends upon keen recognition of what constitutes quality and use of an appropriate incentive structure to reinforce such quality at sufficient levels. This study does not seek to add to the existing debate on how to determine teacher quality, but rather to focus on appropriate use of incentives, particularly the simplest but most important of incentives: compensation practices or, more precisely, teacher salary levels. As will be demonstrated, compensation practices are central to making the teaching profession a competitive alternative in the labor market; to making it more attractive an option to more skilled candidates. In this sense, “teacher quantity and quality are closely linked” (OECD 2004:2). It is, however, necessary to go into further detail with respect to recruitment and retention of said candidates.

*Strategies for Building a Quality Workforce*

The supply-and-demand approach that governs all marketplaces, including that of labor/employment, reminds us that simply boosting the available supply of teachers is not the only strategy at hand for attaining an adequate supply. If a school, district, or state finds itself to be short of an adequate supply of teachers, it may adopt one of three generic approaches:

1) Increase Supply
2) Decrease Demand
3) Increase Compensation

More specifically, we may view improved teacher recruitment as increasing supply, improved teacher retention as decreasing demand, and improved teacher salary levels as increasing compensation.

Although existing literature insists on “two basic policy remedies” for “whenever the quantity of teachers demanded is greater than the quantity of teachers supplied,” increasing pay should be distinguished as its own remedy from the other two mentioned above (Ingersoll 2001:24). Microeconomic theory dictates that compensation relates to the elasticities of, rather than the shifts in, supply and demand. That is, increasing and decreasing pay moves us up and down the supply and demand curves rather than moving the curves themselves. Even if increasing pay technically does not cause shifts in either the supply or demand curves from a microtheory perspective, the fact that it helps to draw the interest of more recruits (and plausibly more skilled recruits at that), as well as to retain current teachers, helps us to understand why it has been advocated in previous literature as a remedy for both increasing supply and decreasing demand (Hanushek & Rivkin 2004; Ingersoll 2001). For this reason, deeper analysis of how pay relates to these other two strategies is warranted.

Recruitment of a Quality Workforce

Analysis of teacher recruitment strategy directs attention toward possible barriers to entering the profession from the perspective of the candidates. It is important to remember that job opportunities in teaching are constant competitors in the employment marketplace, and it is to be expected that candidates will compare such opportunities
against those in other geographic areas and/or different fields of work. One can fathom that existing barriers to entry in any profession, whether it be long hours of training, endlessly complicated paperwork, or any other of a number of tortuous application procedures, factor into such opportunity cost decision-making. In theoretically consistent fashion with prior discussion, research purports that lessening this opportunity cost could take place through either the augmentation of compensation practices or the easing of certification requirements (Gordon, Kane, & Staiger 2006). This defines the attractiveness, or competitive position, of the teaching profession as a function of its compensation practices and certification requirements.

Hanushek & Rivkin (2004) identify “setting teacher certification requirements” as the “most pervasive policy action of states aimed at teacher quality.” Yet, while existing research has demonstrated tremendous variation in quality across the teacher workforce, teacher certification, in addition to virtually all other observable characteristics, has been found to have very little or no effect on teacher effectiveness as defined by student achievement (Aaronson, Barrow, & Sander 2007; Abell Foundation 2001; Ehrenberg & Brewer 1994; Goldhaber & Brewer 2000, 2001; Hanushek & Rivkin 2004, Kane & Staiger 2005; Murnane 1975; Summers & Wolfe 1977; Walsh 2002). The variance in teacher quality is quite substantial within groups of certified and uncertified teachers, rather than between them (Gordon, Kane, & Staiger 2006). Consideration of this evidence in tandem with the fact that teacher salaries have declined in recent decades and are often lower compared to other white-collar occupations (Allegretto, Corcoran, & Mishel 2004; Eide, Goldhaber & Brewer 2004; Horn & Zahn 2001; Turner 1998), and that the number of top female graduates going into teaching has correspondingly fallen
(Hoxby & Leigh 2005; Murnane et. al. 1991), would lead one to infer that the quality of the teacher workforce has declined. These findings are consistent with those made by Murnane et. al. (1991) that enrollment into the teaching profession and district hiring began to decline starting in 1970, as well as those made by Hanushek and Pace (1995), Manski (1987), and Podgursky (2003) that there is statistically significant inverse relationship between academic achievement and a decision to go into teaching among college graduates.

Because setting requirements is, in fact, setting up barriers to entry into the profession, teacher certification cannot be ignored as a policy tool impacting teacher quantity (Goldhaber 2006; Murphy & DeArmond 2003). In this regard, measuring the teaching profession’s opportunity cost relative to competing job opportunities in other geographic areas and different fields of work is an exercise in examination of the strength of the relationship of compensation practices to certification requirements. Heightening certification requirements would constitute a negative shock to supply, as lowering them would constitute a positive shock to supply. In the event of a negative shock to supply, compensation would need to go up in order to keep up with the number of teachers demanded. Of course, “teaching profession” can be substituted with any other form of employment to delineate a basic understanding of free-market relationships.

Retention of a Quality Workforce

A number of studies, including Murnane and Olsen (1989, 1990) and Dolton and van der Klaauw (1995, 1999), have found teacher salaries to be an effective predictor of the number of years that teachers choose to remain in the profession. That is, higher teacher salaries have an important effect on teacher retention. Combining this information
with insights made by Card and Krueger (1992) that teacher experience and salaries result in higher future earning for males, a pattern begins to emerge between teacher compensation, retention, and student achievement.

On the other hand, existing research also indicates that more experienced teachers are often free to choose their schools, or even their students (Greenberg & McCall 1974; Murnane 1981), and that those who do change tend to gravitate toward those locations where student achievement is already higher (Rivkin, Hanushek, & Kain, 2005). The implications of these trends in mobility have severe consequences for minority and low-income students, since the research also shows these teachers moving to wealthier schools (Lankford, Loeb, & Wyckoff 2002; Levin & Quinn 2003; Prince 2002). Schools with significant minority and low-income populations have fewer teachers with relevant subject-matter expertise (Education Trust 2003) and National Board Certification (Humphrey, Koppich, & Hough 2005). Gordon, Kane, and Staiger (2006) found that students in Los Angeles’ poorest schools (90 percent eligible for free/reduced-price lunch) were more than 2.5 times likely to have teachers in the bottom quartile of quality than their peers in the wealthiest schools (less than ten percent eligible for free/reduced-price lunch). For teachers who tend to quit the profession altogether, research shows them to be more academically proficient than those who stay (Hanushek & Pace 1995; Murnane et. al. 1991; Schlechty & Vance 1981).

This directs attention to the importance of working conditions on teachers’ career preferences. Existing research overwhelmingly indicates that such turnover is most attributable to: 1) working conditions, and 2) salary and benefits (Bogler 2002; Hanushek, Kain, & Rivkin 1999, 2004; Hanushek & Rivkin 2004; Hardy 1999; Ingersoll 2001,
2004; Johnson & Birkeland 2003; Kalleberg & Mastekaasa 1998; Luekens, Lyeter, & Fox 2004; Ma & Macmillan 1999; Shen 1997). Some studies have suggested that teachers are willing to sacrifice earnings in exchange for better working environments (Antos & Rosen 1975; Baugh & Stone 1982; Chambers 1977; Hanushek & Luque 2000), and that working conditions, in fact, “trump pay” altogether (Viadero 2008). Working conditions may be defined in terms of heavy workload, professional support, student behavioral problems, adequate facilities and resources, or some combination of all of the above. Research has even gone as far to suggest that improvement of working conditions can enhance teacher effectiveness (Bryk & Schneider 2002; Macdonald 1999; NCTAF 2003; Scott, Stone, & Dinham 2001), though it is unclear whether this effect may be directly causal to current staff or one of simply attracting better teacher candidates.

In juxtaposition, teachers who choose to leave the profession or switch schools ostensibly perceive the level of compensation to be incommensurate with the severity of the working conditions (Goodlad 1984; Ingersoll 2001; Johnson 1990). This is, again, ultimately nothing more than a simple microeconomics lesson in cost-benefit-analysis and tradeoffs. Job opportunities in teaching are constant competitors in the employment marketplace (Boardman, Darling-Hammond, and Mullin 1982; Chambers 1977; Ferguson 1991; Flyer & Rosen 1997), even among those who have already entered into the profession (Dolton & van der Klauuw 1995, 1999; Johnson et. al. 2004; Murnane & Olsen 1989, 1990). Therefore, it should be expected that these teachers will be comparing their current occupations to those in other geographic areas and/or different fields of work. In similar fashion, research purports that lessening the opportunity cost could take place through either the augmentation of compensation practices or the easing of working
conditions (EPE 2008). That is, the attractiveness, or competitive position, of the teaching profession, to those already in it in this case, is a function of its compensation practices and working conditions (Koppich 2008).

In essence, the strength of the relationship of compensation practices to working conditions measures the teaching profession’s opportunity cost relative to competing alternative job opportunities in other geographic areas and/or different fields of work. As working conditions become more challenging, the attractiveness of the teaching profession worsens, causing teachers to either change schools or districts or leave the profession altogether. This, in turn, increases the demand for teachers to fill the vacated classrooms (Ingersoll 2001). Limits on class size and student population growth are additional factors that might impact the demand for more teachers.

The heightening of the severity of working conditions would constitute a positive shock to demand, which would dictate the need for higher compensation. As before, “teaching profession” can be substituted with any other form of employment to delineate a basic understanding of free-market relationships. Any worker in any field would reasonably expect increased pay and benefits to correspond with additional and/or more difficult job responsibilities. In a related sense, with regard to quality, workers who possess a more advanced skill set would be expected to be able request more compensation in exchange for their labor. Or from another angle, higher compensation would help to attract workers with more advanced skill sets.

At the school, district, and state levels of analysis, the principle behind being able to both recruit and retain teachers is one and the same in that the task is to make teaching positions relatively attractive compared with competing job opportunities. Given research
cited above, in addition to the corresponding analytical discussions, one may reasonably
gather that whether the focus is on the recruitment or the retention of teachers,
compensation is an unavoidably fundamental component. Strengthening the relationship
of compensation practices to certification requirements and working conditions in order
to lessen the profession’s opportunity cost relative to competing job opportunities in other
geographic areas and different fields of work is, in actual fact, synonymous with
strengthening efforts to recruit and retain teachers.
Chapter 3. Conceptual Framework and Hypotheses

Conceptual Framework

In practice, building a quality teacher workforce depends on both recognizing quality and offering corresponding incentives. As was stated earlier, this study is solely focused on the incentives side of the issue. While conclusive evidence between particular teacher characteristics and quality has proven hard to come by (see Hanushek, Rivkin, Rothstein, & Podgursky 2004, pp.11-14), “one would expect the supply of high-ability teachers to increase with teacher wages…as the opportunity costs associated with becoming a teacher falls” (Loeb & Page 2000, p. 393). Because it is assumed that higher compensation strengthens the recruitment of teachers,

as it does the retention of teachers,

and more skilled teachers at that (by simply enhancing the quality of the overall candidate pool), it is extrapolated that higher compensation leads to a higher quality teacher workforce.
Hypotheses

After reviewing and analyzing the existing literature regarding the effect of teacher compensation on the quality of the teacher workforce and student achievement, the study begins with the following hypotheses:

**Overall Hypothesis:**
\( H_0: \) Teacher compensation has no significant effect on student achievement.
\( H_1: \) Teacher compensation has a positive and significant effect on student achievement.

**Hypothesis 1:**
\( H_0: \) An increase in district average teacher salary has no significant effect on district average FCAT Reading scores.
\( H_1: \) An increase in district average teacher salary has a positive and significant effect on district average FCAT Reading scores.

**Hypothesis 2:**
\( H_0: \) An increase in district average teacher salary has no significant effect on district average FCAT Mathematics scores.
\( H_1: \) An increase in district average teacher salary has a positive and significant effect on district average FCAT Mathematics scores.

It is hypothesized that higher levels of teacher compensation are associated with higher levels of student achievement. As the diagrams above demonstrate, the theoretical framework posits that this would be an indirect effect. Improved teacher compensation would improve the quality of the teacher workforce, particularly through better recruitment and retention of better teachers which, in turn, would positively impact
student achievement. Therefore, the aim of this research is to measure the impact of a per unit increase in district average teacher salary on district average student FCAT Reading and Mathematics scores.
Chapter 4. Data and Methods

Data

For the independent variables, this study utilizes data from the Florida Department of Education’s Education Information and Accountability Services (EIAS) Publications and Reports. Data appearing in these publications and reports were compiled from the department’s automated student and staff databases in early 2008. The data cover the entire teacher and student populations in Florida public schools for the 2008-2009 year. Throughout the reports, “teacher” is defined as “a professional paid on the instructional salary schedule negotiated by a Florida school district.”

In Florida, teacher salary schedules are adopted annually through collective bargaining activities at the district level. The Florida Department of Education (FLDOE) website warns that districts sometimes adopt salary schedules after the collection of salary data for that school year. In these situations, final negotiated salary schedules may provide retroactive pay to instructional personnel for the entire school year. This causes the salary information on the FLDOE Staff Database to fail to reflect the subsequent salary increase for those districts.

For the dependent variable, this study also utilizes data from the Florida Comprehensive Assessment Test (FCAT) Reading and Mathematics Sunshine State Standards (SSS) test, which is also provided by FLDOE. This criterion-referenced test assesses student achievement on the knowledge and skills described in the state curriculum framework called the Sunshine State Standards. FCAT scores range from 100-500. The data from this test cover the entire student population in Florida public schools grades 3-10 for the 2008-2009 year. Because FCAT data, in its broadest...
presentation, is still broken down by individual grade level, an index is created averaging the average standardized score for each of these grade levels. In effect, the variable “Average FCAT Reading (Math) Score” is the sum of the average reading (math) scores for all grade levels 3-10 divided by eight, or the number of grade levels.

Analysis Plan

Employing Ordinary Least Squares (OLS) multivariate regression, this study will analyze the impact of district teacher populations on their corresponding student populations, after controlling for certain factors in both, in Florida public schools for the 2008-2009 school year. The specific focus will be on the Reading and Mathematics tests of the FCAT, as these are the only sections administered at every grade level 3-10.

Average FCAT Reading Score = $\beta_0 + \beta_1$ (average teacher salary)$+ \beta_2$ (average teacher experience)$+ \beta_3$ (% teachers bachelor’s)+ $\beta_4$ (% teachers master’s)$+ \beta_5$ (% teachers specialist)$+ \beta_6$ (% students male)$+ \beta_7$ (% student eligible for free/reduced-price lunch)$+ \beta_8$ (% students minority)$+ \beta_9$ (% students english language learners)$+ \beta_{10}$ (% students intellectually disabled)$+ u$

Average FCAT Math Score = $\beta_0 + \beta_1$ (average teacher salary)$+ \beta_2$ (average teacher experience)$+ \beta_3$ (% teachers bachelor’s)+ $\beta_4$ (% teachers master’s)$+ \beta_5$ (% teachers specialist)$+ \beta_6$ (% students male)$+ \beta_7$ (% student eligible for free/reduced-price lunch)$+ \beta_8$ (% students minority)$+ \beta_9$ (% students english language learners)$+ \beta_{10}$ (% students intellectually disabled)$+ u$

Further Explanation of Independent Variables

Average teacher salary is measured in thousands of dollars on a districtwide basis. This is consistent with the fact that instructional personnel are paid on a salary schedule negotiated by a Florida school district.

Because teacher salaries typically increase based only on experience and level of the highest degree attained, average teacher years of experience and percentage of
teachers by degree level need to be controlled for. Average teacher experience is measured in years spent in the teaching profession on a districtwide basis. This includes both public and private teaching experience from within and outside the state of Florida. Because teachers’ average number of years of experience greatly impacts the average salary for teachers, this factor needs to be controlled for when comparing average teacher salaries of the districts.

Percentage of teachers by degree level is divided into the following four categories—bachelor’s, master’s, specialist, doctorate—on a districtwide basis. Because teachers’ degree levels greatly impact the average salary for teachers, this factor needs to be controlled for when comparing average teacher salaries of the districts.

Percentages of particular student populations by district will also be controlled for. Studies that show teachers moving systematically to locations of higher earnings likewise show them moving to areas with fewer minority and low-income students (Hanushek, Kain, & Rivkin 2004). Given the established correlations between minority and low-income student populations and teacher mobility in existing literature, controlling for these student characteristics should capture the effects of school working conditions.

Proportionalities in gender for student populations will be controlled for, since male and female students generally mature at dissimilar rates—both physically and mentally—in addition to males being substantially more prone to behavioral problems.

Students eligible for free/reduced price lunch are those covered under the National School Lunch Program and who fall under the United States Department of Agriculture’s guidelines that factor in household income and size in relation to federal
poverty guidelines. A total of four extreme deviant cases where the student population does not fall between 25 to 75 percent being eligible for free/reduced-price lunch are left out of the sample study, leaving a remainder of sixty-three public school districts. A student classified as an English Language Learner is defined in Florida Statutes as “an individual who was not born in the United States and whose native language is a language other than English; an individual who comes from a home environment where a language other than English is spoken in the home; or an individual who is an American Indian or Alaskan native and who comes from an environment where a language other than English has had a significant impact on his or her level of English language proficiency; and who, by reason thereof, has sufficient difficulty speaking, reading, writing, or listening to the English language to deny such individual the opportunity to learn successfully in classrooms where the language of instruction is English” (1003.56(2)). A minority student is simply one not classified as “white.”

Because students categorized as “intellectually disabled” comprise a majority of the Exceptional Student Education population, are most likely to attend regular public schools, and most likely to be admitted an annual FCAT test, this variable is controlled for in an effort to account for the effects of learning disability in student populations.
Chapter 5. Results

Descriptive Results

Table 1 presents the figures of mean, standard deviation, and minimum and maximum values for all of the variables to be tested. The number of observations is sixty-three across all variables, reflecting the fact that they are all valued as either averages or percentages of the sixty-three school districts serving as case studies. The average FCAT Reading score for grades 3-10 is just above 314 points, while that for FCAT Math is higher at above 325 points. Both mean figures are situated near the middle of their respective forty-point spreads, with standard deviations of over eight each. Concerning the specific independent variable of interest, the mean value for average district salary stands at $44,867.21, with a low of $38,848 and a high of $56,272, and a standard deviation of $3613.81. Considerable variance in both the dependent and specific independent variables of interest bodes well for finding significant results in the OLS regression tests.

Regarding teacher characteristics, the mean for district average experience is 12.55 years, with a standard deviation of 1.89 years. This mean figure is situated more closely toward the lower end of the minimum-maximum value spread, which has a range of 8.11 to 19.42 years. When it comes to breakdown by level of highest degree attained, the mean of district averages suggests that nearly two-thirds of teachers have not gone beyond the minimum requirement of earning their bachelor’s, and that more than 97 percent have not gone beyond earning a master’s. Both of these categories also seemingly have considerable variance and range relative to the advanced degrees of specialist and doctorate, with standard deviations hovering around 10 percent each.
The mean gender breakdown for student populations is, as one might expect, close to 50 percent for both male and female, with each also carrying an equal standard deviation of 1.01 percentage points. The mean figure for males is three percentage points greater than that for females, and the minimum and maximum values for males are also both slightly more than six percentage points greater than those for females, suggesting that a typical school district generally has more male students.

The mean district average for percentage of students eligible for free/reduced-price lunch stands at 51.51 percent, suggesting that a narrow majority of public school students qualify for the federal program. A standard deviation of 10.41 percentage points and value range of 29.49 to 70.15 percent indicates considerable variance and lends support to the decision of narrowing the focus of testing to only those school districts falling within the 25 to 75 percent range. The descriptive statistics go on to show that the remaining student population characteristics—minority status, english language learners, intellectually disabled—are all assumed to be either already compensated enough by the free/reduced-price lunch variable or in themselves too small a factor to hinder any efforts at teasing out the effect of teacher salary level, thereby rendering a similar narrowing of focus unjustifiable.

<table>
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<th>Mean</th>
<th>Standard Deviation</th>
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<td>% Female</td>
<td>% Free/Reduced-Price Lunch</td>
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**Student Population Characteristics**

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<th>% Female</th>
<th>% Free/Reduced-Price Lunch</th>
<th>% Minority</th>
<th>% English Language Learners</th>
<th>% Intellectually Disabled</th>
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<td>29.49</td>
<td>70.15</td>
<td>91.12</td>
</tr>
<tr>
<td>% Minority</td>
<td>63</td>
<td>38.35</td>
<td>18.29</td>
<td>6.74</td>
<td>19.4</td>
<td>4.28</td>
</tr>
<tr>
<td>% English Language Learners</td>
<td>63</td>
<td>4.5</td>
<td>4.62</td>
<td>0</td>
<td>19.4</td>
<td>4.28</td>
</tr>
<tr>
<td>% Intellectually Disabled</td>
<td>63</td>
<td>1.34</td>
<td>0.62</td>
<td>0.59</td>
<td>4.28</td>
<td></td>
</tr>
</tbody>
</table>

**Regression Results**

Table 2 presents the OLS regression findings for the impact of average teacher salary level on average FCAT Reading score. The table is broken into three separate models. The first model controls solely for teacher population characteristics, the second for just student population characteristics, and the full model for all characteristics. When controlling for only teacher population characteristics in Model 1, the statistical findings for average teacher salary are too weak to reject the null hypothesis at any meaningful level of significance. Controlling for student population characteristics, which takes place in both the second and full models, does however result in the null hypothesis being rejected at the 5 percent level of significance.

In Model 2, the coefficient estimate on average teacher salary is 0.364, meaning that an increase of $1000 in average salary positively corresponds with an increase of 0.364 points in average FCAT Reading score. Other variables in the model that are statistically significant at or above the ten percent level include: percentage of male students, percentage of students eligible for free/reduced-price lunch, and percentage of minority students. All of these student population characteristics are inversely related with the dependent variable. In layman’s terms, an increase of $2500 in average teacher
salary would be needed to fully offset the effect of a percentage point increase in male student composition, while a $1400 increase would be needed to similarly offset such an increase in students eligible for free/reduced-price lunch, and a $500 increase for said increase in the proportion of minorities.

The full model closely mirrors the two partial models in the sense that all variables tested retain their original positions of statistical significance or insignificance respectively—though the variable capturing percentage of male students does move up in significance from the ten to 5 percent level. The coefficient estimate on average teacher salary slightly drops from its value in Model 2 to 0.351, meaning that an increase of $1000 in average salary positively corresponds with an increase of 0.351 points in average FCAT Reading score. In layman’s terms, a $3000 increase in average teacher salary would be needed to fully offset the effect of a percentage point increase in male student composition, while a $1500 increase would be needed to similarly offset for such an increase in students eligible for free/reduced-price lunch, and a $500 increase for said change in minorities.

<p>| TABLE 2: REGRESSION ANALYSIS OF AVERAGE FCAT READING SCORE (n=63) |</p>
<table>
<thead>
<tr>
<th>Model 1</th>
<th>Model 2</th>
<th>Full Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>117.964</td>
<td>380.238***</td>
</tr>
<tr>
<td></td>
<td>(183.438)</td>
<td>(31.989)</td>
</tr>
<tr>
<td>Average Salary</td>
<td>0.365</td>
<td>0.364**</td>
</tr>
<tr>
<td></td>
<td>(0.316)</td>
<td>(0.195)</td>
</tr>
<tr>
<td>Average Years Experience</td>
<td>0.499</td>
<td>0.190</td>
</tr>
<tr>
<td></td>
<td>(0.520)</td>
<td>(0.298)</td>
</tr>
<tr>
<td>% Bachelor’s Degree</td>
<td>1.609</td>
<td>0.300</td>
</tr>
<tr>
<td></td>
<td>(1.798)</td>
<td>(1.079)</td>
</tr>
<tr>
<td>% Master’s Degree</td>
<td>2.063</td>
<td>0.360</td>
</tr>
<tr>
<td></td>
<td>(1.835)</td>
<td>(1.104)</td>
</tr>
<tr>
<td>% Specialist Degree</td>
<td>1.207</td>
<td>1.021</td>
</tr>
<tr>
<td></td>
<td>(2.048)</td>
<td>(1.184)</td>
</tr>
<tr>
<td>% Male</td>
<td>-0.913*</td>
<td>-1.063**</td>
</tr>
<tr>
<td></td>
<td>(0.629)</td>
<td>(0.629)</td>
</tr>
</tbody>
</table>
Table 3 presents the OLS regression findings for the impact of average teacher salary level on average FCAT Math score. The table is broken into three separate models. The first model controls solely for teacher population characteristics, the second just for student population characteristics, and the full model for all characteristics. When controlling for only teacher population characteristics in Model 1, the coefficient estimate for average teacher salary is statistically significant at the ten percent level. This estimate has a value of 0.492, meaning that an increase of $1000 in average salary positively corresponds with an increase of 0.492 points in average FCAT Math score. None of the other variables in the first model are statistically significant at the ten percent level.

When controlling for student population characteristics, which is done in both the second and full models, the variable on average teacher salary moves up enough in statistical significance to reject the null hypothesis at the 5 percent level. In Model 2, the coefficient estimate on average teacher salary is 0.425, meaning that an increase of $1000 in average salary positively corresponds with an increase of 0.425 points in average FCAT Math score. The other variables in the model that are statistically significant at the ten percent level or greater include: percentage of male students, percentage of students

<table>
<thead>
<tr>
<th>% Free/Reduced-Price Lunch</th>
<th>-0.519***</th>
<th>-0.511***</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0.062)</td>
<td>(0.063)</td>
<td></td>
</tr>
<tr>
<td>% Minority</td>
<td>-0.179***</td>
<td>-0.193***</td>
</tr>
<tr>
<td>(0.045)</td>
<td>(0.050)</td>
<td></td>
</tr>
<tr>
<td>% English Language Learners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.004</td>
<td>-0.0002</td>
<td></td>
</tr>
<tr>
<td>(0.185)</td>
<td>(0.183)</td>
<td></td>
</tr>
<tr>
<td>% Intellectually Disabled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1.228</td>
<td>-0.836</td>
<td></td>
</tr>
<tr>
<td>(1.108)</td>
<td>(1.135)</td>
<td></td>
</tr>
</tbody>
</table>

R2 0.2775 0.7923 0.8186

Note: standard errors are in parentheses.
* statistically significant at ten percent level (one-tailed test)
** statistically significant at 5 percent level (one-tailed test)
*** statistically significant at 1 percent level (one-tailed test)
eligible for free/reduced-price lunch, percentage of minority students, and percentage of student intellectually disabled. All of these student population characteristics are inversely related with the dependent variable. In layman’s terms, a $3500 increase in average salary would be needed to fully reverse the effect of a percentage point increase in male student composition, while a $1000 increase would be needed to similarly reverse a similar increase in students eligible for free/reduced-price lunch, and a $200 increase for said change increase of minority students, as well as a $5000 increase for a proportional change in ESE students categorized as “intellectually disabled.”

The full model closely mirrors the two partial models in that all of the control variables retain their initial levels of significance from the partial models. The coefficient estimate on average teacher salary is 0.475, meaning that an increase of $1000 in average salary positively corresponds with an increase of 0.475 points in average FCAT Math score. In layman’s terms, a $3400 increase in average salary would be needed to fully reverse the effect of a percentage point increase in male student composition, while a $900 increase would be needed to similarly reverse a similar increase in students eligible for free/reduced-price lunch, and a $300 increase for said change increase of minority students, as well as a $4000 increase for a proportional change in ESE students categorized as “intellectually disabled.”

### Table 3: Regression Analysis of Average FCAT Math Score (n=63)

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Full Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>281.660*</td>
<td>409.182***</td>
<td>458.122***</td>
</tr>
<tr>
<td></td>
<td>(179.271)</td>
<td>(36.614)</td>
<td>(135.425)</td>
</tr>
<tr>
<td>Average Salary</td>
<td>0.492*</td>
<td>0.425**</td>
<td>0.475**</td>
</tr>
<tr>
<td></td>
<td>(0.309)</td>
<td>(0.223)</td>
<td>(0.242)</td>
</tr>
<tr>
<td>Average Years Experience</td>
<td>0.487</td>
<td>-0.198</td>
<td>-0.198</td>
</tr>
<tr>
<td></td>
<td>(0.508)</td>
<td>(0.357)</td>
<td>(0.357)</td>
</tr>
<tr>
<td>% Bachelor’s Degree</td>
<td>0.041</td>
<td>-0.416</td>
<td>-0.416</td>
</tr>
<tr>
<td></td>
<td>(1.758)</td>
<td>(1.292)</td>
<td>(1.292)</td>
</tr>
<tr>
<td></td>
<td>Coefficient</td>
<td>Coefficient</td>
<td>Standard Error</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------</td>
<td>-------------</td>
<td>----------------</td>
</tr>
<tr>
<td>% Master’s Degree</td>
<td>0.346</td>
<td>-0.453</td>
<td>(1.794)</td>
</tr>
<tr>
<td>% Specialist Degree</td>
<td>-0.354</td>
<td>0.154</td>
<td>(2.002)</td>
</tr>
<tr>
<td>% Male</td>
<td>-1.470**</td>
<td>-1.599**</td>
<td>(0.720)</td>
</tr>
<tr>
<td>% Free/Reduced-Price Lunch</td>
<td>-0.419***</td>
<td>-0.418***</td>
<td>(0.071)</td>
</tr>
<tr>
<td>% Minority</td>
<td>-0.100**</td>
<td>-0.130**</td>
<td>(0.051)</td>
</tr>
<tr>
<td>% English Language Learners</td>
<td>-0.156</td>
<td>-0.140</td>
<td>(0.211)</td>
</tr>
<tr>
<td>% Intellectually Disabled</td>
<td>-2.097*</td>
<td>-1.886*</td>
<td>(1.268)</td>
</tr>
<tr>
<td>R2</td>
<td>0.2337</td>
<td>0.6978</td>
<td>0.7114</td>
</tr>
</tbody>
</table>

Note: standard errors are in parentheses.
* statistically significant at ten percent level (one-tailed test)
** statistically significant at 5 percent level (one-tailed test)
*** statistically significant at 1 percent level (one-tailed test)
Chapter 6. Discussion

In Florida, district salary levels for teachers appear to have a positive and significant effect on the quality of the overall workforce, as captured by student test scores from the reading and mathematics portions of the state’s standardized exam. The empirical findings above serve as verification that the labor market for teachers is subject to the same microeconomic forces of supply and demand which govern all other markets. Higher compensation for teachers makes the profession a more competitive alternative in the general labor market, leading to higher quality across the workforce. Therefore, teacher salaries constitute a viable policy tool for efforts to improve the performance of public education systems.

The magnitude of these effects, however, suggests that a simple policy of across-the-board salary increases alone for reversing negative effects in working conditions—as captured in student characteristics such as gender, ethnicity, and socioeconomic status—would likely prove one of considerable expense. In addition, the current primary determinants behind increases in teacher salary—years of experience and level of the highest degree attained—have no visible impact on student achievement, raising even further concern over issues of cost effectiveness. Because teacher salaries and benefits already account for the greatest portion of overall funding in public education, and because efficient construction of a quality workforce also depends on appropriate recognition and reinforcement of quality, further research is needed on structural incentives behind teacher compensation, recruitment, and retention in order to help policymakers determine how to maximize the effect of increases in teacher salaries. In other words, moving forward, research should be geared toward determining how to

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compensate teachers in addition to how much. Additional research directed toward certification requirements, professional support, and availability of quality facilities and resources and their relationship with teacher effectiveness should be conducted as well, as these are all themselves plausible factors affecting the supply, demand, and quality of teacher candidates.
References


Viadero, D. (2008) “Working Conditions Trump Pay: When it comes to retaining teachers, studies suggest that the circumstances of their jobs may matter even more than their salaries” *Education Week*, January 10, 1.